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Long–term evolution of Saturn's E ring particles

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Abstract

Obviously, there is an intimate connection between the dynamics of the particles and the spatial structure of a diffuse ring. The particle dynamics determines the distribution of their orbital elements, which in turn governs the spatial density of the ring particles. However, the relation between the dynamics of individual particles and the ring properties is neither necessarily simple nor can this relation be derived without prior knowledge directly from in-situ or telescopic observations. Data obtained by "local" in-situ measurements as well as by "global" camera observations only reflect the conditions within the observed volume element, which are the result of a complex superposition of particles of different origin, age, size, and dynamical properties. As a consequence, the interpretation of ring data always requires knowledge of the ring's orbital element distribution, which has to be obtained by other means. Numerical simulations of the ring particle ensemble may provide the missing link between empirical observation and the concealed nature of the ring. The presented work attempts to derive the distribution of the orbital elements of Saturn's diffuse E ring from numerical simulations of individual ring particles. The results will then be applied to data recently obtained by the Cassini dust detector.